

Species

Relationship between Water Bodies and Vulture Populations in Bundelkhand, India

Kanaujia A¹, Kushwaha S²*

1. Biodiversity and Wildlife Conservation Lab Department of Zoology, University of Lucknow, Lucknow-U.P.-226007, India
2. Biodiversity and Wildlife Conservation Lab Department of Zoology, University of Lucknow, Lucknow-U.P.-226007, India

*Correspondence to: Biodiversity and Wildlife Conservation Lab Department of Zoology, University of Lucknow, Lucknow-U.P.-226007, India

Publication History

Received: 28 July 2014

Accepted: 30 August 2014

Published: 5 November 2014

Citation

Kanaujia A, Kushwaha S. Relationship between Water Bodies and Vulture Populations in Bundelkhand, India. *Species*, 2014, 11(27), 6-19

ABSTRACT

Vultures are master scavengers of India. Decline in vulture population is reported since 1950-1970s in India and its neighbouring countries; although a steep decline in there population was reported in mid 1990s at an alarming pace. The study was required to find out the vulture scenario in Bundelkhand Region. Besides the roosting, breeding and feeding behaviour of vultures, two other behavioural aspects are also important for the survival and protection of theses scavengers. These are bathing and drinking. There is noteworthy relation between the forest coverage, water bodies and vulture population. The study of this behaviour in turn reflects the importance of water bodies for vultures.

Keywords: Scavengers, vultures, water bodies, behaviour

1. INTRODUCTION

Simply the fact that birds are a vital link in Nature's chain is enough to justify their importance. But there are also many ways in which they are directly useful to us (Ali, et al., 2008). Some birds are very good scavengers. Between them, the crows and kites dispose of all the small dead animals and the garbage, which otherwise would litter our roads and lanes. The master scavengers of India are, of course, the vultures. Vultures, the denizens of sky were one of the most commonly sighted birds in India. Decline in their population is reported since 1950-1970s in India and its neighbouring countries (Ogada et al., 2012), although a steep decline in there population was reported in mid 1990s at an alarming pace. Major causes are loss of habitat, low food availability, infectious diseases, use of veterinary

Observational count in an area

This method is simple but reliable for surveying vultures. With the aid of a pair of binoculars, four hours were used each day to observe and record the birds of prey (vultures) within the area. This observation was done between the hours of 7:00 am to 9:00 am and 4:00 pm to 6:00 pm when vultures were seen at roosting and breeding sites. This was carried out sitting at a point with a good view of the surrounding landscape. The landscape was scanned and all individuals seen perched or flying were counted.

Drought

Drought is an extended period when a region receives a deficiency in its water supply, whether atmospheric, surface or ground water. A drought can last for months or years, or may be declared after as few as 15 days.

Scavenger

Scavenging is both a carnivorous and a herbivorous feeding behavior in which the scavenger feeds on dead animal and plant material present in its habitat.

drugs, general environment contaminations, deliberate poisoning of carnivores leading to secondary poisoning of vultures, exploitation and persecution, effects of transportation, infrastructure, and recreation as well as intentional assassination by aviation authorities to prevent aircraft accidents (Satheesan et al., 2000). Throughout their range, vultures fulfill an important ecological role, and their absence could cause ecological imbalances. Although studies are being carried out throughout the Indian Sub-Continent, this was the first extensive study on vultures in Bundelkhand Region regarding the status, behaviour, and threats. The study was required to find out the vulture scenario in Bundelkhand Region. Besides the roosting, breeding and feeding

behaviour of Nature's preeminent scavengers, two other behavioural aspects are also important for the survival and protection of these disposal squads. These are bathing and drinking. The study of these behaviours in turn reflects the importance of water bodies for vultures. The Bundelkhand region – approximately an area of 70,000 square kilometers with 21 million people, nearly the size and population of Sri Lanka, comprising 15 districts of Madhya Pradesh (M.P.) and Uttar Pradesh (U.P.) – faced its worst ever drought spell in living memory, affected all the flora and fauna (Khurana et al., 2008).

2. STUDY AREA

The study is carried out in an area of two states of India, Uttar Pradesh and Madhya Pradesh known as Bundelkhand (Figure 1). Bundelkhand lies between 23° 35'–26° N and 78°–82° E. The climate of Bundelkhand area is of typical Central Indian climate, with mild winters and hot summers. Hot wave flows during May and first week of June locally designated as “Loo”. The temperature during summer goes upto 48°C. The rainy season is limited to one and a half to two months of July and August only. Winter rain fall is rare. Average rain fall is 600 - 700 mm but concentrated only during July – August. Most of the rain fall is run-off due to rocky nature of the soil (Special Project for Bundelkhand Region 2009-10 & 2011-2012). Bundelkhand is a hot and semi-humid region.

3. METHODOLOGY

Secondary data was collected to identify the possible vulture occurrence spots within the districts of Bundelkhand Region. Regular visits were made in the selected regions to count the number of breeding pairs at each colony. Indirect signs of vultures in particular such as white washes and molted feathers were searched to locate vulture breeding colonies. Surveys were carried out on the basis of the following key criteria: presence of water body, safe trees, large rocks and cliffs, wildlife, livestock population, and carcass dumping ground (Chhangani, 2009). Sugar factories, Bone mills and fertilizer factories were also key criteria for survey work. Observational recordings were done Using data sheets and 10x50 binoculars. Photographical recordings were with the help of Digital Kodak 12X Zoom Camera, 1000D SLR Canon Camera and 60D SLR Canon Camera and Video recordings were with the help of Digital Kodak 12X Zoom Camera and 1000D SLR Canon Camera.

4. RESULT AND DISCUSSION

There is noteworthy relation between the forest coverage, water bodies and vulture population (Graph 1). The districts such as Lalitpur, Tikamgarh, Panna and Shivpuri have excellent vulture populations because they have permanent and sufficient water availability due to the major rivers. The Districts Lalitpur, Tikamgarh, Panna and Shivpuri have sanctuaries and National Parks, thus providing undisturbed habitat together with water bodies. This supports the thriving vulture colonies with perceptible number of nests (Graph 2). Although the vulture population depends on the livestock for food, the presence of water bodies plays an equally important role (Graph 3). The vulture population is low even if the livestock is present and this is due to insufficient water bodies. The occurrence of vulture population, vulture nesting sites, water bodies and livestock population in Bundelkhand region have a remarkable relation (Graph 4).

After identifying the breeding colonies in the study area, it was observed that all the nesting sites were close to a source of water body (Figure 2 and 3), be it a river, dam or canal, such as Betwa, Dhasan, Ken, Pahuj taal, Shukhwan Dhukwan Dam, Sakhya Sagar, and Mahdavi Sagar (Table 1).

There is a strong relation between the water bodies and the vulture nesting sites. Lalitpur, Tikamgarh, Shivpuri and Panna have a healthy breeding population due to the major rivers (Betwa, Jamni, Dhasan, Ken) flowing throughout the year along the sites selected for nesting. Since there is relation between the forest coverage, water bodies and vulture population, therefore the nesting sites are also related. Vultures are clean birds they take a bath

after every meal so water bodies are important. They do this so that the blood from carcasses does not stay in their feathers or on their skin, infecting the vultures with diseases (Figure 4).

Vultures feed on the carcasses that may contain harmful disease causing organisms. While feeding on them, the contaminants get adhered to the bald head, neck, feathers and legs. The scavengers may thus get infected, and so after each meal vultures take a bath to get rid of all these. Vultures are thus hygienic birds. Vultures regulate their body temperature through hydrolysis (Snyder et al., 1991; Houston, 1994; Sick, 1997). These birds void their excretory wastes on the legs, a behaviour that cools the legs as the water contained in the wastes evaporates. As the water also cools the blood circulating under the evaporative surfaces of the legs, the blood cooled this way circulates through the body and thus radiate excessive heat (Snyder et al., 1991). A behaviour that would prevent a dangerous build-up of uric acid through urohydrolysis is bathing, which is a way to regulate body temperature as well. Bathing in cold days and rain-bathing may have other function than regulation of body temperature, however. As the lives of vultures depend on efficiency of their wings, feather maintenance is of utmost importance to these birds (Houston, 1994). Vultures generally drink water from clean water bodies mainly rivers and ponds (Figure 5).

But there are incidences when black vultures have been reported to drink water polluted with domestic sewage, this may be related to carrion-eating habits of vultures (Sazima, 2010). The fledglings mostly drink from the river banks and avoid getting into the muddy areas of the water bodies as they may get tangled in the marshy areas because the wings are not strong enough to take them off and they may get drowned also (Figure 6). The Egyptian vultures are seen drinking water from agricultural fields when they are irrigated with water pumps. Similar is the case with the fledglings of *Gyps indicus* that enjoy bathing and drink water when the gardens in archaeological monuments are watered by the care takers.

The study shows that the causes of vulture decline are also in accordance to the climatic conditions, increase in urbanization, anthropogenic activities as well as financial status of people of Bundelkhand region. Eighty percent people depend on agriculture and livestock rearing. Rainfall has been deficient by 40-50 percent for the last five years across the districts (Table 2). The current drought in Bundelkhand impacted 16 million people; 40 percent farms were not sown bringing down food production by 30 percent while 70 percent of ponds and tanks dried up. More than 20 lakh livestock were abandoned, a major source of livelihood for local communities. Districts like Tikamgarh and Lalitpur were left with 20-30% of their previous livestock (Dogra, 2008).

In spite of this factor no initiatives were taken to solve the problem of drought. Though there was hardly a live stream or well in the region, the M.P. government had been promoting water intensive industries for development of the region that would be using the region's mineral resources and none for agriculture. Bundelkhand is rich in iron, rock phosphates, diamonds, pyrophyllites, granites, dolomites, limestones, and sandstones and marble. Out of the 36 MoUs with the investors, 6 were for steel and captive power plants, 5 for cement plants, 11 for iron and ferroalloy and 1 for alumina. All these industries are water guzzlers. The government promised all the industries preferential land and water sources. In spite of this, there were eight MoUs for taking up large-scale Jatropa and bio-diesel plantation. These are water intensive crops and there are reports of such crops leading to depletion in groundwater (Khurana et al., 2008). The hot and dry climate of Bundelkhand proves fatal to the juveniles that learn flying and foraging during May-June. May is generally the hottest month with mean daily maximum temperature at about 43°C and minimum 29°C. On individual day temperature may raise upto about 47°C. The driest part of the year is summer season when the relative humidity is less than 20% in the afternoons. A case study of dehydrated juvenile in June 2009 showed that it suffered from heat stroke as well as lack of proper food. This case also showed that neck dropping in vultures may not be correlated to poisoning in all cases. The juvenile adopted neck dropping behaviour, which was considered as symptom of avian gout after which the bird died (Dogra, 2008). But here in spite of this neck dropping (Figure 7), the juvenile recovered and survived. Neck dropping was seen in other healthy adults as a response to high temperature (Kanauija et al., 2012). It is also seen in juveniles during the hot summers in Bundelkhand region (Figure 8). Some studies suggest that this may be a thermoregulatory response since this posture is seen mainly during hot weather (Watson et al., 2008).

Water bodies are essential and plays central role in the daily activities of vultures. The monitoring of existing water bodies as well as the drying up of water bodies is significant. Water bodies should be therefore conserved and an alternative perennial source should be ensured near the existing vulture colonies where water sources have been disturbed.

5. CONCLUSION

There are various reasons for the declining vulture population. It is important to remove the local threats to the vulture populations. This is observed in the study area as uncontrolled mining, logging, as well as disturbance and drying of water bodies due to various reasons. The severe drought from 2002-2007 in Bundelkhand impacted 16 million people; 40 percent farms were not sown bringing down food production by 30 percent while 70 percent of

Livestock

Livestock are domesticated animals raised in an agricultural setting to produce commodities such as food, fiber and labor.

Avian gout

Gout is a musculoskeletal disorder affecting the muscles and bones around the joints of the bird. Gout is mainly due to damaged kidneys (nephropathy). When they stop functioning normally, it results in an accumulation of uric acid and urates in the muscles and joints.

ponds and tanks dried up. It is seen that the vulture population is low even if the livestock is present and this is due to insufficient water bodies. Water bodies are an important part of vulture behaviour. Therefore it is concluded that all the water bodies near the vulture identified sites should be protected, maintained and regularly cleaned near feeding sites as vultures need water bodies to take a bath after feeding on carcasses. Continued studies are required in the region. Vultures have not vanished. Nature is giving another chance to save them. It is imperative to study all the local aspects associated with them and the major threats to the last surviving population. The comprehensive study will in turn mark the way for conservational requirements including mass awareness as well as Co-ordination and understanding between various departments such as Forest Department (for surveying and monitoring of vulture colonies), Archaeological Department (for protecting of nests in monuments), Tourism Department (preventing disturbance by tourists), Agriculture Department (avoiding use of harmful pesticides and drugs) and Education Department (for awareness among local people, students, villagers, forest officials) as well as people. The conservation is not possible with a single authority or a group of people.

SUMMARY OF RESEARCH

1. Vultures are master scavengers of India. There steep population declines have been reported from India and its neighbouring countries since 1950s-1970s. Although studies are being carried out throughout the Indian Sub-Continent, this was the first extensive study on vultures in Bundelkhand Region regarding the status, behaviour, and threats. The study was required to find out the vulture scenario in Bundelkhand Region.
2. There is a strong relation between the water bodies and the vulture nesting sites. Lalitpur, Tikamgarh, Shivpuri and Panna have a healthy breeding population due to the major rivers (Betwa, Jamni, Dhasan, Ken) flowing throughout the year along the sites selected for nesting. Since there is relation between the forest coverage, water bodies and vulture population, therefore the nesting sites are also related. Vultures are clean birds they take a bath after every meal so water bodies are important. They do this so that the blood from carcasses does not stay in their feathers or on their skin, infecting the vultures with diseases.
3. The small water bodies were dried and used for construction work in various places while the severe drought from 2002-2007 in Bundelkhand impacted 16 million people; 40 percent farms were not sown bringing down food production by 30 percent while 70 percent of ponds and tanks dried up.
4. Therefore it is concluded that all the water bodies near the vulture identified sites should be protected, maintained and regularly cleaned near feeding sites as vultures need water bodies to take a bath after feeding on carcasses. Continued studies are required in the region.

FUTURE ISSUES

There are various causes for the decline of these scavengers. No single cause is applicable to this drastic fall in vulture population. The reasons vary with the change in climate, change in living style, change in cattle keeping pattern, change in modernization in different regions of India and its neighbouring countries. The Scientific groups should concentrate on the causes of decline locally and then suggest for conservational measures required for the vultures.

ACKNOWLEDGEMENT

Thanks are due to the Chief Wildlife Warden of Forest Department Uttar Pradesh and Madhya Pradesh for providing the permission to carry out the study. We highly appreciate the co-operation of Forest Officials of all the districts of Bundelkhand during the survey work. Special thanks to Mr. Narayan Singh and Mr. Shyamlal, tourist guards in Archaeological Department of Orchha and all the volunteers specifically Mukesh Kewat without whom the field exercise would not have been easy. We acknowledge Uttar Pradesh State Biodiversity Board for their financial assistance and Department of Zoology, University of Lucknow U.P. for the constant support. We would particularly like to express our heartfelt thanks to Anil Kumar Chhangani (Associate Professor at M.G.S University, Bikaner, Rajasthan) who is a constant source of inspiration and guidance.

REFERENCES

1. Ali S, Futehally L. About Indian Birds. Wisdom Tree. Print Perfect, New Delhi, 2008
2. Ogada DL, Keesing F, Virani MZ. Dropping dead: causes and consequences of vulture population declines worldwide. *Ann. N.Y. Acad. Sci.* 2012, 1249, 57-71 [PMID: 22175274]
3. Satheesan SM, Satheesan M. Serious vulture-Hits to aircraft over the world. Amsterdam, 2000, 113-126
4. Khurana I, Mahapatra R. Drought and drinking water crisis in Bundelkhand: Half full half empty. Water and Sanitation Perspective Series 01, 2008
5. Special Project For Bundelkhand Region, 2009-10 to 2011-2012
6. Chhangani A. Status of vulture population in Rajasthan, India. *Indian Forester.* 2009, 135(2), 239-251
7. Snyder NFR, Snyder HA. Birds of prey: natural history and conservation of North American raptors. Stillwater: Voyageur Press, 1991
8. Houston DC. Family Cathartidae (New World vultures), p. 24-41. In: J. del Hoyo, A. Elliot and J. Sargatal (eds.). Handbook of the birds of the world. Vol. 2. New World vultures to guineafowl. Barcelona: Lynx Edicions, 1994
9. Sick H. Ornitologia brasileira, uma introdução. Rio de Janeiro: Editora Nova Fronteira, 1997
10. Sazima I. Black Vultures (*Coragyps atratus*) pick organic debris from the hair of a domestic dog in southeastern Brazil. *Revista Brasileira de Ornitologia*, 2010, 18(1), 45-48
11. Dogra B. Water Aid India, 2008

12. Kanaujia A, Kushwaha S. A Case Study on Indian Vulture (*Gyps indicus*) rescued in Orchha, Madhya Pradesh, India. *ZOO's PRINT*, 2012, Volume XXVII, No. 2, 20-22.
13. Watson RT, Gilbert M, Virani M. Neck dropping posture of Oriental White-backed vulture (*Gyps bengalensis*) in close proximity to human observers. *Journal of Raptor Research*. 2008, 42, 66-67
14. Report on Drought Mitigation Strategy for Bundelkhand region of U.P. and M.P. Inter-ministerial Central Team, Delhi, May 2008
15. Indian Council of Agricultural Research Nagpur, *Land Use Plan for Development of Bundelkhand Region Based on Land and Soil Resources Survey*, National Bureau of Soil Survey and Land Use Planning, 1981

Table 1

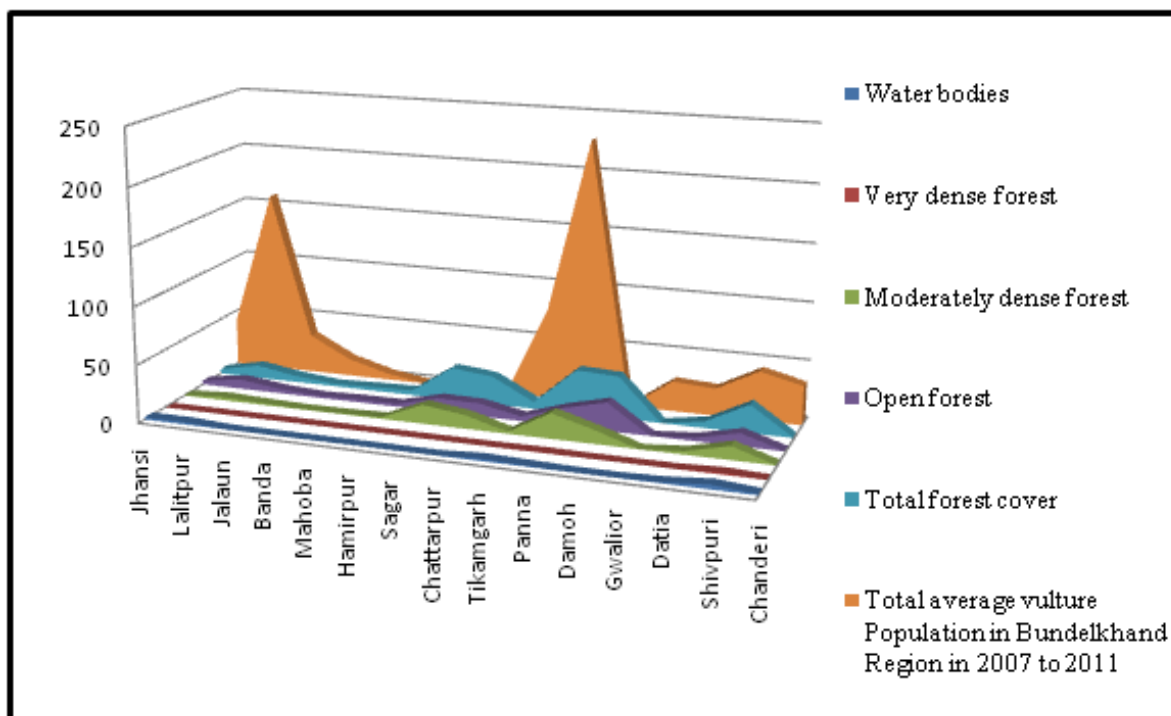
Relation between water bodies and vulture colonies

S.No.	Districts	Water bodies	Vulture colony
1	Jhansi	Pahuj Taal and Sukma Dhukma Dam	cliffs
2	Lalitpur	Betwa and Dhasan river	cliffs
3	Jalaun	-	-
4	Banda	-	-
5	Mahoba	-	-
6	Hamirpur	-	-
7	Sagar	-	-
8	Chattarpur	-	-
9	Tikamgarh	Betwa and Jamni river	Trees and monuments
10	Panna	Ken river	Cliffs and trees
11	Damoh	-	-
12	Gwalior	-	Monuments
13	Datia	Small seasonal water bodies	Monuments and trees
14	Shivpuri	Sakhya Sagar and Madhav Sagar on Manier river and Betwa river respectively.	Cliffs and trees
15	Chanderi	Dam	Cliffs

Table 2

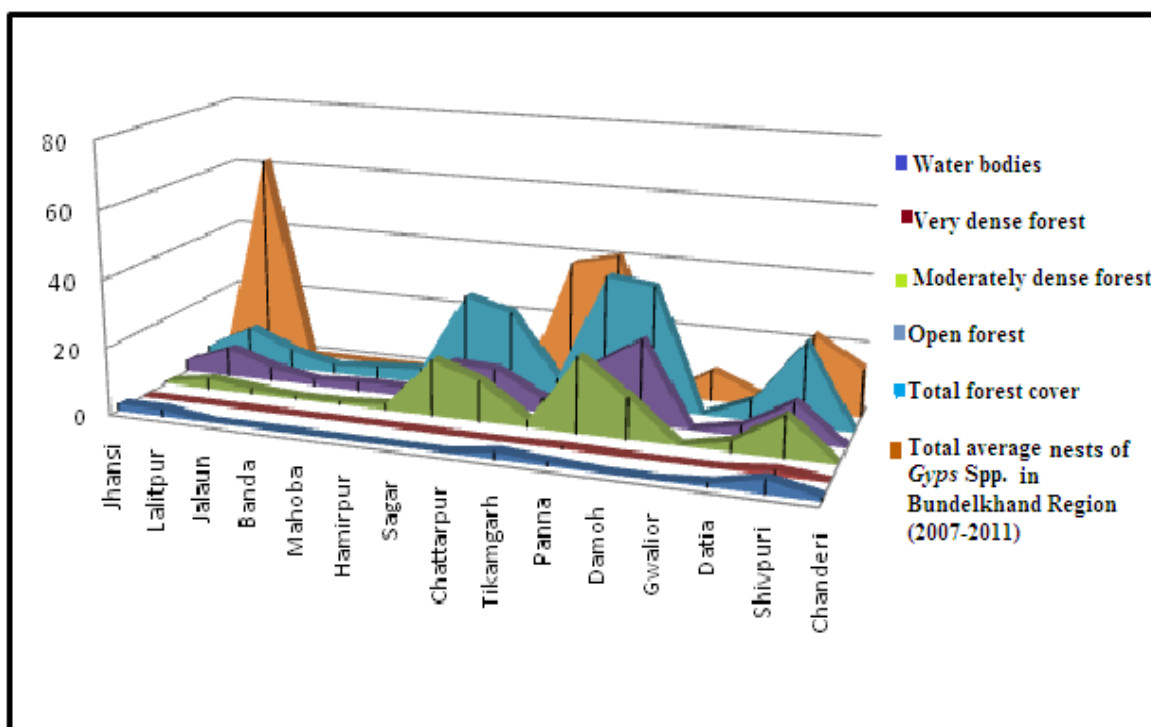
Deficit rainfall across Bundelkhand Region during 2004-2008 (Report on drought mitigation strategy for Bundelkhand Region of U.P and M.P. Inter-ministerial Central Team, 2008)

Districts	Normal rainfall (mm)	2004-05	2005-06	2006-07	2007-08
Uttar Pradesh		Deviation in %			
Lalitpur	879	-19	-34	-54	-40
Jhansi	880	-39	-24	-52	-61
Jalaun	787	-23	-24	-52	-61
Hamirpur	851	-30	-37	-51	-50
Banda	851	-30	-2	-52	-57
Chitrakoot	945	-14	-8	-22	-60
Mahoba	940	-19	-40	-21	-66
Madhya Pradesh		Deviation in %			
Chhatarpur	984.8	-10	-9	-44	-54
Tikamgarh	971.5	-46	-28	-43	-64
Damoh	1065.4	-9	-53	-27	-22
Sagar	1086.7	-34	-29	-47	-34
Datia	767.8	-34	-29	-47	-34
Panna	1069.6	-12	-33	-46	-67



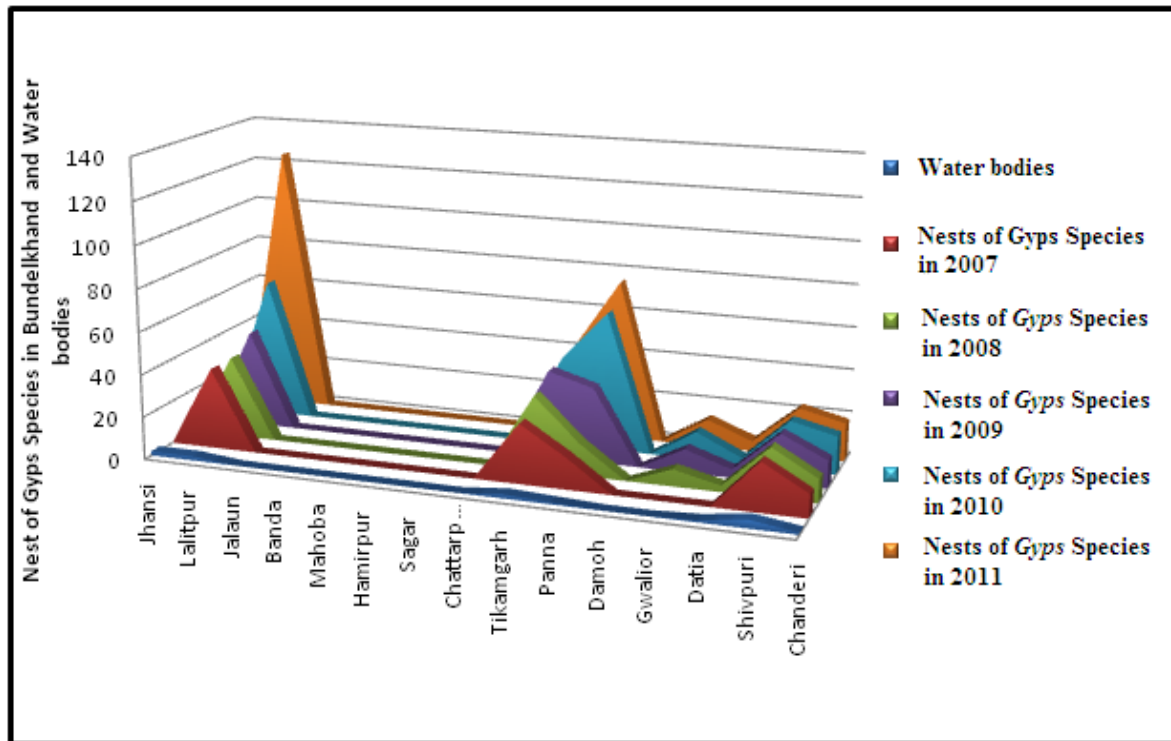
Graph 1

Forest cover as percentage of total geographical area (2005) and relation between water bodies and vulture population in Bundelkhand Region



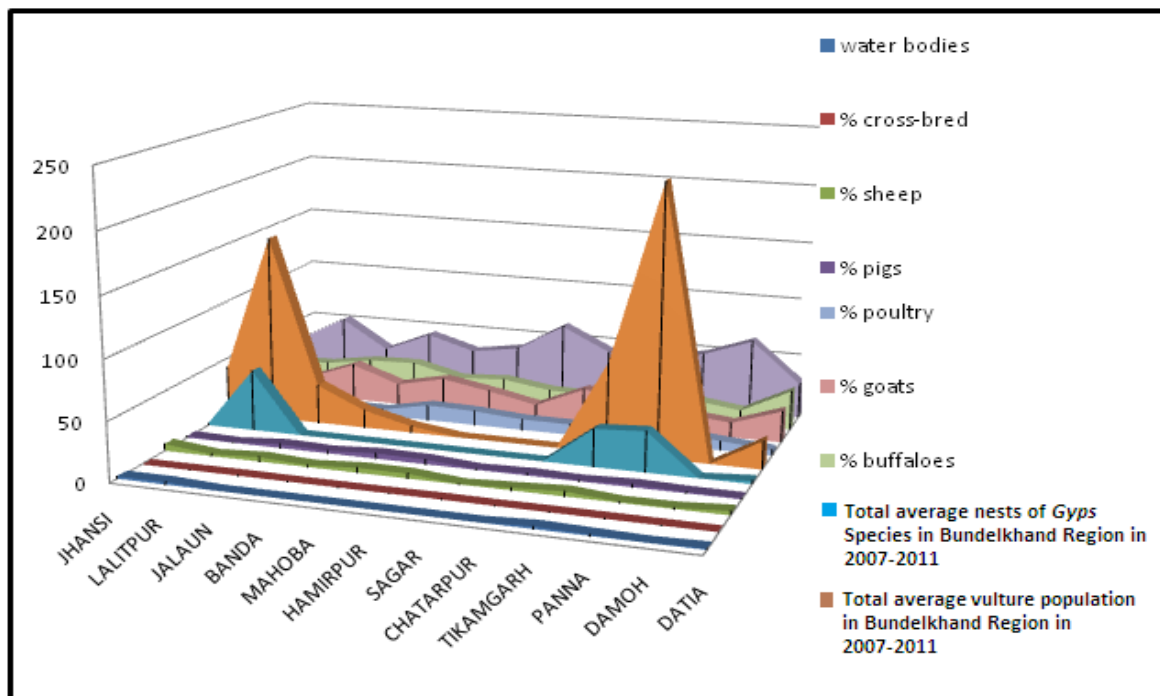
Graph 2

Forest cover as percentage of total geographical area (2005) and relation between water bodies and vulture nest in Bundelkhand Region



Graph 3

Relation between the water bodies and Gyps species nesting sites in Bundelkhand Region



Graph 4

Livestock population under main categories (2003), water bodies and Total Average Nest of Gyps Species and Vulture Population in Bundelkhand 2007 to 2011

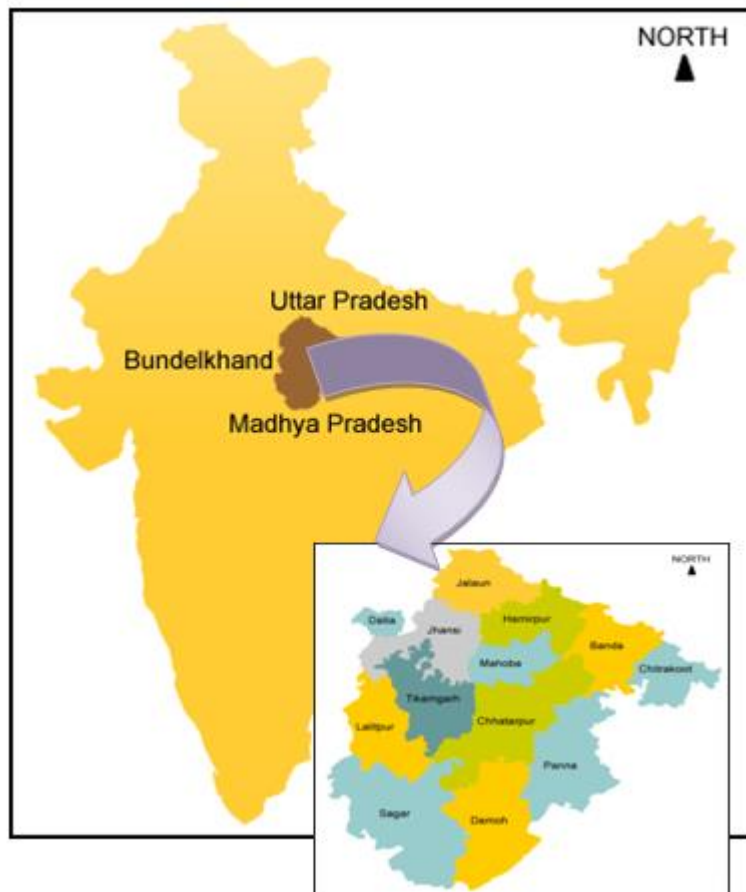


Figure 1

Map of India showing Bundelkhand Region (Indian Council of Agricultural Research Nagpur, 1981)

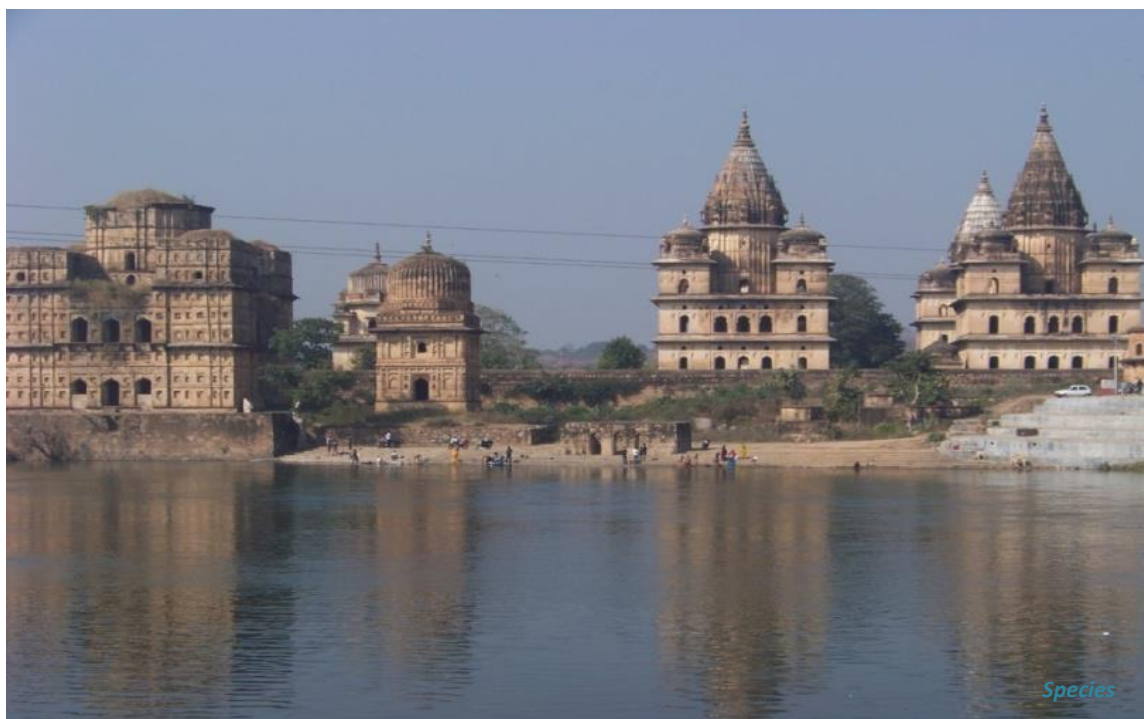


Figure 2

Monuments are the nesting sites, close to a source of water body (river Betwa) in orchha, Tikamgarh (Madhya Pradesh)

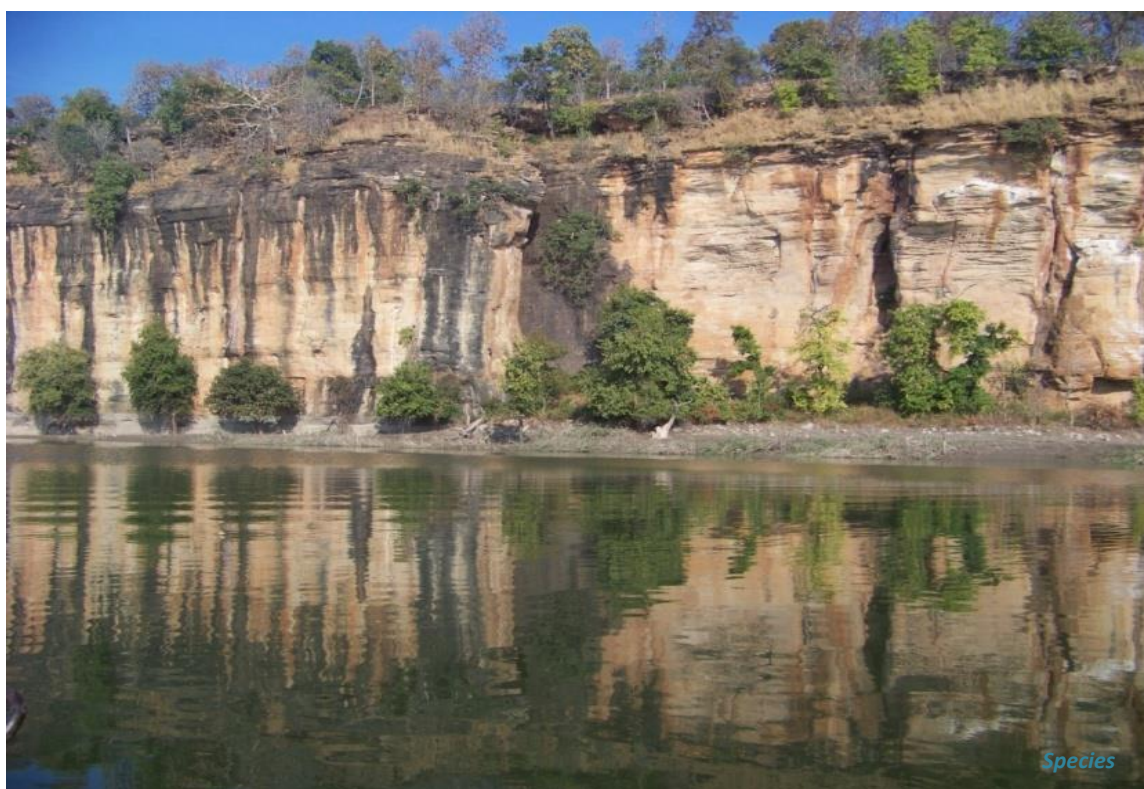


Figure 3

Cliffs are the nesting sites, close to a source of water body (river Betwa) in Deogarh, Lalitpur (Uttar Pradesh)



Figure 4

Gyps indicus taking bath at Betwa River, Orchha, Madhya Pradesh



Figure 5

Egyptian Vulture along a pond



Figure 6

Juveniles avoid getting into the muddy areas of rivers



Figure 7

Neck dropping is a thermoregulatory response



Figure 8

Neck dropping is commonly seen in juveniles during hot summers